Center for Healthcare Technologies

We are creating a center that will coordinate ongoing Laboratory research aimed at developing more cost-effective tools for use by the healthcare community. The new Center for Healthcare Technologies will have many long-term benefits for the region and the nation.

In the U.S., we now spend about 13% of the gross domestic product (GDP) on healthcare. This figure represents nearly $3000 per year per man, woman, and child. Moreover, this expenditure is projected to grow to about 20% of the GDP by the year 2000.[1] Medical research and development accounts for only about 3% of national healthcare spending, and technology development represents only a small fraction of that 3%.

New technologies that are far more cost-effective than previous ones—such as minimally invasive surgical procedures, advanced automated diagnostics, and better information systems—could save the nation billions of dollars per year to say nothing of the potential reductions in pain and suffering. A good example of how improved technology can benefit the individual is the portable blood-glucose testing meter now available to diabetics. This quick and convenient self test costs only a few dollars and can be used daily at home, whereas each standard laboratory test costs $25 to $40 and requires a special trip to a medical facility.

Over the last decade, many projects exploring improved or new healthcare technologies have evolved from diverse and often independent research efforts at LLNL. *Energy and Technology Review* has described some of these remarkable advances.[2] We have shown how Laboratory researchers are developing better imaging systems, such as pulsed x-ray lasers and prototype components required for fully digital screening mammography. We are constantly improving the instrumentation and information systems required for genetics research, and, in the process, we discovered the gene associated with myotonic dystrophy. Using improved sensor and detection systems—accelerator mass spectrometry (AMS) in particular—we can now reliably detect trace chemicals in biological samples at levels that previously could not be measured.

Table 1. **This table shows the broad spectrum of LLNL healthcare projects outside the Biology and Biotechnology Research Program, where studies on genetics and cancer risk and prevention are ongoing. Many of the following projects are interdisciplinary in nature and most involve external collaborators.**

LLNL discipline	Project description
Chemistry and materials science	Osteoporosis research X-ray computed tomography to characterize tooth decay Clinical application of lasers to tooth root dentin
Computations	Models for neuromuscular function of the human hand
Defense-related research	New ways to measure oxygen in blood Image enhancement of chest x rays Optical laser imaging of teeth Short-pulse tissue removal Short-pulse, broadband imaging of soft tissue Noninvasive blood monitoring
Energy	Magnetic resonance imaging devices Radioactive medicinal drugs as tracers
Engineering	Studies on incipient failure in a new heart valve X-ray spectra for dose-efficient imaging Antiscatter grid for improved mammographic imaging Microtechnology for clinical instrumentation Crash and impact injury effects
Engineering, biology and biotechnology	Advanced microinstrumentation Microfabricated instruments for polymerase chain reaction Digital mammography for early cancer detection Biological sample analysis using diode lasers Computer-aided diagnostics in mammography
Engineering, biology and biotechnology, chemistry and materials science	New biocompatible materials for use in prosthetic devices (e.g., artificial joints and bone)
Lasers	Microthin lens for opthamology Lasers for surgery and photodynamic therapy Lasers for medicine X-ray lasers for biomedical applications
Physical sciences	Tritium sample chemistry for biomedical AMS ^{3}H and ^{41}Ca as tracers for biomedical applications of AMS Medical applications of computational physics Biomedical and environmental isotope tracer research Modeling studies for radiation therapy X-ray lasers for biological microimaging
Health services	Digital vibrogram to test for carpal tunnel syndrome

These and scores of other approaches can potentially improve the healthcare of millions of people.

The scope of LLNL's work in the area of healthcare technology has increased in recent years. Our Biology and Biotechnology Research Program has major efforts in genetics research and instrumentation and in the causes and prevention of cancer. In addition to these important efforts, Table 1 shows the large number of currently funded projects now under way in other disciplines at the Laboratory. Most of these projects involve one or more university collaborators or industrial partners.

In late 1992, LLNL Director John Nuckolls addressed the need to explore a more coordinated effort in the field of healthcare technology. In August 1993, Tony Carrano, Associate Director for the Biology and Biotechnology Research Program, formed a Healthcare Technology working group. Today, we are creating a new cross-disciplinary center at LLNL, to be named the Center for Healthcare Technologies (CHT).

The CHT will focus on cost-effective, high-technology healthcare products and systems that can be made available to all. A primary mission for the Center will be to explore the ways in which the Laboratory can become a leader and catalyst for healthcare technology development.

The benefits of the CHT will be felt at the national, regional, and local levels. At the national level, we will provide better healthcare tools at lower cost. At the state level, we want to spark healthcare technology sectors in California and further our working alliances with medical researchers at institutions such as Kaiser Permanente, Stanford University, UC Davis, UC San Francisco, and many others. For the Laboratory itself, the CHT can help create new research programs and serve as a model for coordinating projects that, by their very nature, will continue to span many different programs.

Key Words: accelerator mass spectrometry (AMS); Center for Healthcare Technologies (CHT); digital mammography; genetics research; healthcare; pulsed x-ray imaging.

Notes and References

1. Projections for healthcare expenditures in the next century are from "The National Health Care Phobia," *Newsweek*, September 6, 1993, and *Technology Review,* October 1993.
2. For a description of digital mammography, see the October–November–December 1992 issue of *Energy and Technology Review* (UCRL-52000-92-10/11/12), pp. 27–36; for a capsule summary of advances related to accelerator mass spectrometry and pulsed x-ray laser imaging, see the January–February 1994 issue of *Energy and Technology Review* (UCRL-52000-94-1/2), pp. 30–35; for improved diagnostics and instrumentation in the field of genetics, see the April–May 1992 issue of *Energy and Technology Review* (UCRL-52000-92-4/5), pp. 29–62; for improved computer detection of features in biomedical images, see the May 1993 issue of *Energy and Technology Review* (UCRL-52000-93-5), pp. 7–13.

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